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CONTINUED PROSECUTION APPLICATION (CPA) REQUEST TRANSMITTAL Submit an original, and a duplicate for fee processing (Only for Continuation or Divisional applications under 37 CFR 1.53(d))		<input type="checkbox"/> DUPLICATE
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Address to: Assistant Commissioner for Patents Box CPA Washington, DC 20231	Attorney Docket No.	1247-0709-3VF PCT
	First Inventor	Jean-Paul DEBALME
	Group Art Unit	1733
	Examiner	AFTERGUT, J

This is a request for a ☒ continuation or ☐ divisional application under 37 CFR 1.53(d)
(continued prosecution application (CPA)) of prior application number **08/913,518**
filed on **11/4/1997** and entitled **PROCESS AND DEVICE FOR THE MANUFACTURE OF**
11/3/1999 as a CPA **A COMPOSITE MATERIAL**

1. ☒ Enter the unentered amendment previously filed **MAY 29, 2001** under 37 CFR 1.116 in the prior nonprovisional application.

2. ☐ A preliminary amendment is enclosed.

3. ☐ This application is filed by fewer than all the inventors named in the prior application, 37 CFR 1.53 (d)(4)
a. ☐ DELETE the following inventor(s) named in the prior nonprovisional application:

b. ☐ The inventor(s) to be deleted are set forth on a separate sheet attached hereto.

4. ☐ A new power of attorney or authorization of agent (PTO/SB/81) is enclosed.

5. Information Disclosure Statement (IDS) is enclosed:
a. ☐ PTO-1449
b. ☐ Copies of IDS Citations

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CLAIMS	NUMBER FILED		NUMBER EXTRA	RATE	CALCULATIONS
TOTAL	11	MINUS 20	0	× \$18 =	\$0.00
INDEPENDENT	3	MINUS 3	0	× \$80 =	\$0.00
		<input type="checkbox"/> MULTIPLE DEPENDENT CLAIMS		+ \$270 =	\$0.00
		BASIC FEE			\$710.00
		TOTAL OF ABOVE CALCULATIONS			\$710.00
		<input type="checkbox"/> Reduction by 50% for filing by Small Entity			\$0.00
		TOTAL			\$710.00

6. Small Entity Status:

☐ Applicant claims small entity status. See 37 CFR 1.27.

7. ☒ The Commissioner is hereby authorized to charge fees under 37 CFR 1.16 and 1.17 for the papers being filed herewith and for which no check is enclosed, or credit any overpayment to Deposit Account No. **15-0030**.

☒ If these papers are not considered timely filed by the Patent and Trademark Office, then a petition is hereby made under 37 CFR 1.136 for the necessary extension of time in the parent case. Any fees required for such an extension of time may be charged to Deposit Account No. **15-0030**.

8. ☒ A check in the amount of **\$710.00** is enclosed.

9. ☐ Other:

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Respectfully submitted,

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5-1-98IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF: :
Jean-Paul DEBALME et al. : APPLICATION DIVISION
SERIAL NO: New PCT Application :
(Based on PCT/FR97/00101)
FILED: HEREWITH :
FOR: PROCESS AND DEVICE FOR :
THE MANUFACTURE OF A
COMPOSITE MATERIAL

PRELIMINARY AMENDMENT

ASSISTANT COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

SIR:

Prior to examination on the merits, please amend the above-identified application as follows:

IN THE CLAIMS

Please amend Claims 4-7, 11-13 as follows:

Claim 4, ~~line 1~~, change "any one of the preceding" to --Claim 1--;
~~line 2~~, delete "claims".

Claim 5, ~~line 1~~, change "any one of Claims 1 to 3" to --Claim 1--.

Claim 6, ~~line 1~~, change "any one of Claims 1 to 3" to --Claim 1--.

Claim 7, ~~line 1~~, change "any one of Claims 1 to 3" to --Claim 1--.

Claim 11, ~~line 1~~, change "any one of Claims 7 to 10" to --Claim 7--.

Claim 12, ~~line 1~~, delete "any one of the preceding";

~~line 2~~, change "claims" to --Claim 1--.

Claim 13, ~~line 2~~, change "either of Claims 8 and 9" to --Claim 8--.

Please add new Claims 15-20 as follows:

~~15.~~ Process according to Claim 2, characterized in that the glass threads and the material which are deposited are exclusively in the form of at least one strip of fabric and/or of knit formed at least partially by commingled threads.

16. Process according to Claim 3, characterized in that the glass threads and the material which are deposited are exclusively in the form of at least one strip of fabric and/or of knit formed at least partially by commingled threads.

17. Process according to Claim 2, characterized in that the deposited material is exclusively in the form of chopped threads.

18. Process according to Claim 3, characterized in that the deposited material is exclusively in the form of chopped threads.

19. Process according to Claim 2, characterized in that the deposited material is exclusively made up of continuous threads.

20. Process according to Claim 3, characterized in that the deposited material is exclusively made up of continuous threads.--

REMARKS

The above amendment corrects the dependency of the claim structure and eliminates multiple dependent claims as well as adds new Claims 15-20. Each of the claims are fully supported by the specification. No new matter is added. Therefore a full and thorough examination on the merits of the Claims 1-20 is requested.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
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A handwritten signature in black ink, appearing to read 'Greg Maier', with a long horizontal flourish extending to the right.

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PROCESS AND DEVICE FOR THE MANUFACTURE
OF A COMPOSITE MATERIAL

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The present invention relates to a process and
5 to a device for making use of the said process for the
manufacture of a composite material, formed by the
association of reinforcing fibres, such as glass
fibres, and of a thermoplastic organic material.

There are already numerous processes which make
10 it possible to associate glass fibres and a
thermoplastic organic material. The glass fibres may be
in the form of a mat of continuous threads or of
chopped threads and/or of fabrics; the organic material
may be in the liquid form or in the solid state in the
15 form of powder, film, sheet or of threads. The choice
of the form in which the glass fibres and the organic
material are associated depends on the configuration of
the article to be produced and on the properties which
are required for the said article.

Also, when the configuration of the article is
20 relatively simple and when its mechanical properties
must be high, the reinforcement chosen is in most cases
in the form of fabric. The utility certificate
FR-2 500 360 illustrates the use of reinforcement of
25 this type: the manufactured articles are flat panels or
curved articles which are produced by hot pressing of
superposed layers of fabrics of, for example, glass
fibres; the thermoplastic organic material associated
with the glass thread fabrics being in the filamentary
30 form. These thermoplastic threads may be warp or weft
threads or both at the same time. During the hot
pressing these threads melt and, on cooling, will bind
the glass fabric layers together. The composite
laminates thus produced are characterized by a high
35 content of reinforcing fibres.

The process for the manufacture of these
laminates is a noncontinuous process, according to
which a number of layers of fabrics are superposed and
the combination of the said layers is then heated while
40 they are being compressed in a static press.

More recently, patent US-A-5 227 236 has proposed an improvement to the process described above: the improvement consists in the use of mixed or, preferably, commingled threads which are sized with a dispersion or an emulsion of a thermoplastic polymer. Mixed threads should be understood to mean threads obtained by the simultaneous assembling and reeling of reinforcing threads such as glass threads and thermoplastic organic threads; commingled threads should be understood to mean threads obtained by the assembling and reeling of a multiplicity of reinforcing filaments and of thermoplastic organic filaments, the said filaments having previously been separated by mechanical means from their original threads. The melting point of the polymer employed for sizing these threads is lower than that of the organic filaments. Thus sized, these threads are employed in the form of fabrics. By virtue of this improvement the time needed to produce a sheet by hot pressing is found to be reduced. However, this, too, is a noncontinuous process.

For the production of composite articles of complex configuration it is known to employ a reinforcement which has the advantage of being in the form of a continuous thread which can be moved with the thermoplastic organic material under the effect of the pressure exerted during the moulding operation.

The manufacture of such a product which is suitable for moulding is described, for example, in patent US-A-4 277 531. According to this patent, a mat of continuous glass threads is, in a first step, needled in order to give it the cohesion needed for its being handled; in a second step, on a manufacturing line, two strips of mat which has thus been needled are brought along parallel paths to a hot-pressing device, where they are combined. The lower face of the bottom strip rests on a film of thermoplastic organic material; the upper face of the topmost strip is also

covered with a film of the same kind. Just before the mat strips are combined, a device deposits a layer of thermoplastic material in the liquid state. This combination is simultaneously heated and compressed so
5 as to ensure at least partial melting of the films of organic material and, after cooling, the bonding of the threads of which the mats consist.

This process has the advantage of permitting the continuous manufacture of a sheet of a composite
10 material which is ready to be moulded. However, while the product thus obtained is easily mouldable, the content of reinforcing fibres in the final article remains limited.

The subject of the present invention is a
15 process which makes it possible to manufacture continuously a composite product in which the content of reinforcing fibres is higher than that attained by the continuous processes known hitherto.

The subject of the present invention is a
20 process which makes it possible to manufacture continuously a composite product in sheet form, at a rate which is at least as high as that of the best continuous processes known in this field.

Another subject of the present invention is a
25 process which makes it possible to manufacture continuously a composite product in sheet form, which combines the mouldability characterizing the products which contain nonwoven reinforcements and which gives the product obtained by moulding the level of
30 mechanical properties that characterizes products containing woven reinforcements.

The objectives of the invention are attained by virtue of a process which consists:

- in continuously depositing onto a moving
35 substrate glass threads of which at least 80 % by weight thereof are commingled threads consisting of glass filaments and of filaments of thermoplastic organic material which are intimately blended, the

quantity of glass deposited representing more than 40 %
by weight of the total quantity of material deposited
in the form of glass threads and of organic material,

- in transferring this glass threads-organic
5 material combination into a number of zones where the
said combination is heated, compressed and cooled, the
heating and/or the cooling of the said combination
being simultaneously accompanied by its compression,

- in cutting up the said combination in the form
10 of sheets or in winding it onto a rotating drum.

Commingled threads are intended to mean threads
in which glass filaments and filaments of thermoplastic
organic material are intimately blended. These threads
can be obtained by mechanical means as described, for
15 example, by patent US-A-4 818 318. According to this
patent the reinforcing threads and the thermoplastic
threads are extracted from their respective windings
and then the filaments of which they consist are
separated in the form of two sheets of the same width.
20 These sheets are next brought into contact with one
another to form only a single sheet, the two kinds of
filaments being alternated as uniformly as possible.
All the filaments thus blended are combined into a
single thread.

25 Commingled threads are also intended to mean
those which are directly obtained during the
manufacture of thermoplastic organic filaments and of
glass filaments. Processes permitting the manufacture
of such a thread are described, for example, in patent
30 applications EP-A-0 599 695 and EP-A-0 616 055. In
these processes, filaments obtained by extrusion and
mechanical drawing of a thermoplastic organic material
in the molten state are drawn in the form of a sheet
and are blended with a bundle or a sheet of glass
35 filaments (or are sprayed into the said bundle or the
said sheet), the said glass filaments being also in the
course of being drawn. By virtue of this kind of

process a thread within which the various filaments are blended homogeneously is thus obtained directly.

5 A moving substrate is intended to mean a strip of material formed by the combination of threads of glass and of a thermoplastic organic material, for example a strip of fabric formed by glass threads of which at least 80 % by weight thereof are commingled threads as defined above.

10 A moving substrate is also intended to mean a conveyor which carries the glass threads-organic material combination from one point to another of a manufacturing line.

15 According to a first embodiment of the process according to the invention the glass threads and the material which are deposited continuously onto the substrate are exclusively in the form of at least one strip of fabric and/or of knit which are formed at least partially by commingled threads.

20 The fabrics employed within the scope of the invention include commingled threads which may be warp or weft threads, preferably both at the same time. Similarly, the knits employed may consist partially or totally of commingled threads.

25 According to a second embodiment of the invention the material deposited onto the substrate is exclusively in the form of chopped threads.

30 According to a third embodiment the material deposited onto the substrate is exclusively in the form of continuous threads. These threads may be deposited in the direction of movement in the substrate or in the form of superposed loops.

35 According to a fourth embodiment of the invention, at least one strip of fabric and/or of knit which are formed at least partially of commingled threads is deposited onto a substrate and at least one sheet of commingled threads, chopped or continuous, is also deposited, the said sheet(s) being brought into contact with at least one of the faces of the said

strip(s), and then the sheet(s) of threads-strip(s) of fabric and/or knit combination thus formed is heated and is compressed on its two faces before being cooled and cut up.

5 According to a first alternative form of this latter embodiment:

- a) - a sheet of chopped commingled threads is deposited onto a moving conveyor,
- b) - a strip of fabric formed exclusively by
10 commingled threads is deposited onto the said sheet,
- c) - a second sheet of chopped commingled threads is optionally deposited onto the strip of fabric,
- d) - the sheet(s)-strip(s) combination thus formed
15 is transferred into a first zone where the said combination is heated and then into a second zone where the said combination is simultaneously compressed and heated,
- e) - the said combination is then transferred into a third zone in which it is compressed and cooled,
- 20 f) - the said combination thus cooled is cut up at the exit of the third zone.

 According to a second alternative form of this embodiment:

- a) - a first strip of fabric formed exclusively by
25 commingled threads is deposited onto a moving conveyor,
- b) - a sheet of chopped commingled threads is deposited onto this strip,
- c) - a second strip of fabric exclusively formed by commingled threads is deposited onto this sheet,
- 30 d) - a second sheet of chopped commingled threads is optionally deposited onto this latter strip of fabric,
- e) - the strip(s)-sheet(s) combination thus formed is transferred into a first zone where the said combination is heated, and then into a second zone
35 where the said combination is simultaneously compressed and heated,
- f) - the said combination is transferred into a third zone in which it is compressed and cooled,

g) - the combination thus cooled is cut up at the exit of the third zone.

According to a third alternative form of this embodiment:

- 5 a) - a first strip of fabric formed exclusively by commingled threads is deposited onto a moving conveyor,
- b) - one or more continuous commingled threads are deposited onto this strip,
- c) - a second strip of fabric formed exclusively by
10 commingled threads is deposited onto the said continuous thread(s),
- d) - one or more continuous commingled threads or a sheet of chopped commingled threads is optionally deposited onto this latter strip of fabric,
- 15 e) - this strip(s)-sheet(s) combination thus formed is transferred into a first zone where the said combination is heated, and then into a second zone where the said combination is simultaneously compressed and heated,
- 20 f) - the said combination is transferred into a third zone in which it is compressed and cooled,
- g) - the combination thus cooled is cut up at the exit of the third zone.

Within the scope of the fourth embodiment of
25 the invention and of its alternative forms the width of the sheet(s) of commingled threads which is (are) deposited is preferably equal to the width of the strip(s) of fabric and/or of knit with which it is (they are) combined.

30 When strips of fabric and/or of knit and sheets of chopped or continuous threads are combined, sheets are obtained in which the middle part and/or at least one of the surface layers consist of at least one layer of glass threads capable of moving in a mould during
35 the operation of moulding of the said sheets.

When a sheet of chopped threads is deposited, it may be obtained from a distributing device situated at the base of a storage hopper for prechopped

commingled threads. It is also possible to obtain this sheet directly from a cutter fed continuously with a multiplicity of rovings of commingled threads extracted from a multiplicity of windings.

5 The layer of continuous commingled threads may be obtained by scattering one or, preferably, more thread(s) with the aid of one or more devices continuously fed with one or more threads extracted from windings.

10 The sheets or the layers of continuously deposited threads are preferably of the same width as the strips of the fabric which are employed.

15 In the process according to the invention the weight of glass which is deposited may represent at least half of the total weight of material deposited onto the conveyor.

20 The detailed description below will allow the invention and the advantages which it offers to be appreciated better. This description will be illustrated by a number of figures which represent:

- Figure 1: a device which permits a first implementation of the invention,
- Figure 2: a device which permits a second implementation of the invention,
- 25 - Figure 3: a device which permits a third implementation of the invention,
- Figure 4: a graph on which are plotted the mechanical characteristics of composite products obtained according to known processes and according to
- 30 the invention.

These various devices are described by way of examples and cannot in any way constitute a limitation of the invention.

35 Figure 1 shows diagrammatically a line for production of composite sheets which includes upstream at least one multistorey creel 10 on which is placed a multiplicity of windings of commingled threads 11. The threads extracted from these windings are guided and

combined by various members before entering a cutter 12. The chopped threads are collected and transferred by means of a conveyor belt 13 into a storage silo 14.

5 A capacitor with a perforated drum 15, joined by a conduit 16 to the base of the silo 14, feeds chopped threads to a first coater shaft 17 as commonly employed in the textile industry.

This shaft 17, equipped with a metering device, distributes the chopped threads in the form of a first
10 sheet 18 onto a moving conveyor 19.

Downstream of the shaft 17 and above the conveyor 19 is installed a device with a small barrel 20 provided with two spindles which are free in rotation and support two rolls of fabrics 21 and 22,
15 made up of commingled threads. A strip of fabric 23, extracted from the roll 21, is applied by means of a device 24 onto the sheet 18. When the roll 21 is finished, the device 20 pivots by 180° in order to continue the unwinding of a strip of fabric from the
20 roll 22. To facilitate changing the roll, a fabric-accumulator and a device ensuring the positioning of the strip 23 (which are not shown) are fitted between the small barrel 20 and the device 24. These devices are shown in Figure 3, which itself illustrates another
25 embodiment of the invention, and are commented on below.

Downstream of the device 20 is fitted a second shaft 25, also fed with chopped threads by virtue of a capacitor with a perforated drum 26 connected by a
30 conduit 27 to the silo 14. This shaft 25, equipped with a metering device, distributes the chopped threads in the form of a second sheet 28 onto the strip of fabric 23. This sheet is compressed by means of a device 29 placed at the exit of the said shaft.

35 This "sandwich" formed by a strip of fabric of commingled threads, taken between two sheets of commingled chopped threads, is introduced into a preheating oven 30. This oven allows this sandwich to

be heated to a temperature which is higher than the melting temperature of the thermoplastic organic material of which a portion of the filaments blended with the glass filaments is formed. This heat treatment
5 can be carried out, for example, by means of hot air.

Thus heated, the sandwich then enters a press 31 of a known type, for example such as that described in patent US-A-4 277 531.

This press essentially includes two belts 32
10 and 33, driven respectively by rolls 34, 35 in the case of the first one and 36 and 37 in the case of the second one. The rolls 34 and 36 are heated; the rolls 35 and 37 are cooled. It also includes, between these two pairs of rolls, two zones in which the sandwich is
15 compressed on its two faces and is driven. In the first zone 38 the means of pressing contribute to the heating of the sandwich to a temperature which is higher than the melting temperature of the thermoplastic organic material; in the second zone 39 the means of pressing
20 perform a cooling function which is supplemented by the action of the rolls 35 and 37.

A cooled, rigid strip comes out of the press 31 and is cut up by an automatic guillotine device 40 in the form of sheets 41.

Figure 2 shows diagrammatically a line for production of composite sheets according to a second embodiment of the invention. As in the preceding embodiment, a creel 10, on which a multiplicity of windings of commingled threads 11 is placed, is fitted
30 at the beginning of the line. These threads also feed a cutter 12. The threads chopped by this means are collected and transferred by a conveyor belt 42 to the top of a hopper 43 placed above a moving conveyor 19.

Upstream of this conveyor is fitted a device
35 with a small barrel 44 provided with two spindles which are free in rotation and support two rolls of fabric 45 and 46, which are made up of commingled threads. A strip of fabric 47, extracted from the roll 46, is

applied onto the conveyor 19. The hopper 43, which enables a sufficient quantity of threads to be stored in order to work on the cutter without interrupting the manufacture, is used to feed, through the intermediacy of conveyor belts 48 and 49, a coater shaft 50. The latter delivers a sheet of chopped threads 51 onto the moving belt 47.

Downstream of the shaft 50 is fitted, above the conveyor, a second device with a small barrel 52 provided with two spindles which are free in rotation, which support two rolls of fabric 53 and 54, also made up of commingled threads. A strip of fabric 55 is extracted from the roll 53 and is applied onto the sheet 51 at the exit of the shaft 50, by virtue of a device 56. As in the case of the first embodiment, a fabric-accumulator and a device ensuring the positioning of the strip of fabric (which are not shown) are fitted between the small barrel 44 and the upstream part of the conveyor 19 and between the small barrel 52 and the device 56 (see Figure 3).

This "sandwich" made up of a sheet of chopped threads taken between two strips of fabric is, as previously, introduced into a preheating oven 30 before entering a press 31 which is identical with that described in the context of the first embodiment of the invention. The rigid sheet which comes out of it is cut up by a guillotine device 40 in the form of sheets 57.

.Figure 3 shows diagrammatically a line for production of composite sheets according to a third embodiment of the invention.

As in the embodiments described above, a creel 10 on which is placed a multiplicity of windings 11 of commingled threads is installed upstream of the line. These threads are extracted from the windings 11 and are then guided and combined by various devices to form rovings 58.

The extraction of these threads is carried out by means of three devices 59 which are at the same time

devices for driving and distributing the said rovings. These devices are enclosed in a housing 60 fitted above the upstream part of the conveyor 19.

5 This line also includes two devices with a small barrel 44 and 52 which support rolls of fabric made up of commingled threads fitted, as in the line shown in Figure 2, upstream and downstream of the devices 59 for distributing the rovings.

10 A first strip of fabric 61, consisting of commingled threads, is unwound at constant tension from the roll 46. This strip runs into a fabric-accumulator 62 and then into a rotary frame 63 fitted with a selvage-detector which allows it to be positioned accurately before the said strip comes into contact
15 with the conveyor 19. When the roll 46 is finished, the small barrel 44 pivots in order to place the roll 45 in an unwinding position.

The end of the strip 61 is stopped at the device 64 for the time needed to sew it to the
20 beginning of the strip from the roll 45. During this time the reserve 62 provides the feed of fabric to the line.

A second strip of fabric 65, also consisting of commingled threads, is deposited onto the sheet of
25 rovings 58 which have themselves been deposited onto the strip of fabric 61. This strip 65 is unwound at constant tension from the roll 54; it runs into a fabric-accumulator 66 and then, after a return 67, into a rotary frame 68 equipped with a selvage-detector
30 which enables the said strip to be positioned accurately in relation to the strip 61 and the sheet of rovings 58.

The sandwich 69 made up of the sheet of rovings 58 and the strips 61 and 65 enters a hot air oven 30
35 supported by a perforated and relatively nonadhesive strip 70, for example a PTFE-coated glass grid. When passing through this oven the sandwich 69 is heated to a temperature above the melting temperature of the

thermoplastic organic material. On leaving the oven the sandwich is reduced in volume by being lightly compressed between the rolls 71.

As in the preceding embodiments, the sandwich
5 next enters a press 31 equipped with two belts 32 and 33, in which it is heated to a temperature which is higher than the melting temperature of the thermoplastic organic material. Between the rolls 34 and 36, which are heated, and the rolls 35 and 37,
10 which are cooled, this press is equipped with a pair of rolls 72 and 73, which are heated. These rolls also compress the sandwich and promote the removal of the air which is still present therein.

A cooled, rigid strip comes out of the press 31
15 and runs into a device 74 equipped with saws 75 which remove the selvages from the said strip.

As in the preceding embodiments, this strip is cut transversely by a guillotine device 40, controlled automatically by haul-off rolls 76 which are adjusted
20 to obtain sheets 77 of a determined length.

In these examples of embodiment of the invention, any one device or other can be replaced by another device which, as a whole, performs the same function. Thus, the press 31 could be replaced by a
25 calender equipped with several pairs of rolls ensuring a progressive decrease in the temperature of the sandwich, or by a calender made up of a single pair of thermostated rolls, followed by twin belts ensuring the movement and the cooling of the said sandwich.

30 The process according to the invention and its implementation which have been described above make it possible to produce continuously composite sheets in which the glass thread content can reach and exceed 60 % by weight.

35 Thus, by way of example, composite sheets have been produced in the following conditions by employing a production line as illustrated by Figure 3.

The fabrics employed have a balanced 2 twilled 2 bound weave of 650 g/m² including 4 identical weft and weave rovings. These rovings comprise 800 glass filaments with a mean diameter of 17 micrometres and
5 800 polypropylene filaments with a mean diameter of 22 micrometres. The sheet of chopped commingled threads is made up from the same rovings.

A first strip of fabric (61) 1.4 metres in width, is unwound and deposited on the conveyor (19)
10 which travels at the speed of 2 metres per minute.

The cutters (59) placed above the conveyor (19) deliver 8 kilogrammes of chopped threads per minute. These chopped threads, 38 millimetres in length, are deposited onto the strip (61) and form a sheet of
15 2.8 kilogrammes per square metre.

A second strip of fabric (65) is unwound and deposited onto the sheet thus formed.

The sandwich (69) thus formed runs into the oven (30) heated to 200°C by means of hot air
20 circulation. On leaving the oven (30) the sandwich (69) is compressed with the aid of the two water-cooled rolls (71). The sandwich, the thickness of which is then approximately 5 millimetres, enters the belt press (31). In the first zone of this press, included between
25 the pairs of rolls (34, 36) and (72, 73), which are heated, the sandwich is heated to a temperature of the order of 230°C. In the second zone of this press, included between the pairs of rolls (72, 73) and (35, 37), the latter pair being cooled, the sandwich is
30 progressively cooled to a temperature of the order of 30°C. During the passage of these two zones the sandwich is subjected to a pressure of the order of 1.5 bar. A planar product, the thickness of which is approximately 3 millimetres, leaves the press (31) and
35 is trimmed and then cut up in the form of sheets. A one-square metre sheet weighs approximately 4.2 kilogrammes.

In the graph shown in Figure 4 are plotted, as ordinate, the values of the tensile and flexural strengths, expressed in megapascals, of various glass-polypropylene composite products whose glass content, expressed in percentages by weight and by volume, is plotted as abscissae.

The products whose glass content has a top value of 50 % by weight are obtained by continuous manufacturing processes of the prior art; those in which the glass content is equal to 60 % by weight are obtained by the process according to the invention.

The continuous manufacture processes of the prior art combine glass threads and polypropylene films by heating and compression.

In the final product these glass threads can be present either in the form of a mat of chopped threads (shown as x) or in the form of a mat of continuous threads (shown as O,•).

The values of the tensile strengths of the products obtained according to the present invention (shown as)) relate both to products manufactured solely from fabrics, themselves exclusively consisting of commingled threads, and to products manufactured solely from chopped commingled threads (C33 - length 33 millimetres) and to mixed products such as that whose manufacture has been described, by way of example, above (30 % fabrics; 70 % C38 threads).

-Independently of the fact that the process according to the invention makes it possible to obtain continuously composite products in which the glass content is higher than that in the products obtained according to the known processes, the extrapolation of the straight lines passing through the values of the strengths of the known products shows that the strengths of the products according to the invention are at least equal to, or even higher than, those which it would be rightful to expect merely as a result of the increase of the glass content. This shows that the

quality of the wetting of the glass threads by the thermoplastic organic material reaches an exceptional level.

5 The products obtained by the process according
to the invention are particularly well suited for
obtaining, by moulding or by stamping, articles of
complex shape like, for example, the very numerous
composite components that form part of the design and
the manufacture of motor vehicles. In this respect, the
10 mixed products combining fabrics and chopped or
continuous threads simultaneously combine the good
distribution of the reinforcement in a mould of complex
shape and the high level of mechanical properties which
are required of the component which is produced.

CLAIMS

sub B1

1. Process for the manufacture of a composite product obtained by the association of glass threads and of a thermoplastic organic material in the filamentary state, which consists:

- in continuously depositing onto a moving substrate glass threads of which at least 80 % by weight thereof are commingled threads consisting of glass filaments and of filaments of thermoplastic organic material which are intimately blended, the quantity of glass deposited representing more than 40 % by weight of the total quantity of material deposited in the form of glass threads and of organic material,

- in transferring this glass threads-organic material combination into a number of zones where the said combination is heated, compressed and cooled, the heating and/or the cooling of the said combination being simultaneously accompanied by its compression,

- in cutting up the said combination in the form of sheets or in winding it onto a rotating drum.

2. Process according to Claim 1, characterized in that the substrate is a strip of fabric formed by glass threads of which at least a portion thereof are commingled threads consisting of glass filaments and of filaments of thermoplastic organic material.

3. Process according to Claim 1, characterized in that the substrate is a conveyor.

4. Process according to ~~any one of the preceding claims~~, characterized in that the glass threads and the material which are deposited are exclusively in the form of at least one strip of fabric (and/or) of knit formed at least partially by commingled threads.

5. Process according to ~~any one of claims 1 to 3~~, characterized in that ~~the deposited material~~ is exclusively in the form of chopped threads.

Claim 1

Claim 1

said one layer

cannot be must be for nonwoven only

a

a

c

sub E2

Claim 1

6. Process according to ~~any one of Claims 1 to 3~~, characterized in that ^{said one layer} ~~the deposited material~~ is exclusively made up of continuous threads.

Claim 1

7. Process according to ~~any one of Claims 1 to 3~~, characterized in that at least one strip of fabric and/or of knit which are formed at least partially of commingled threads is deposited onto the substrate and in that at least one sheet of commingled threads, chopped or continuous, is also deposited, the said sheet(s) being brought into contact with at least one of the faces of the said strip(s), and then the sheet(s) of threads-strip(s) of fabric and/or knit combination thus formed is heated and is compressed on its two faces before being cooled and cut up or wound.

8. Process according to Claim 7, characterized in that:

a) - a sheet of chopped commingled threads is deposited onto a moving conveyor,

b) - a strip of fabric formed exclusively by commingled threads is deposited onto the said sheet,

c) - a second sheet of chopped commingled threads is (optionally deposited onto the strip of fabric,

d) - the sheet(s)-strip(s) combination thus formed is transferred into a first zone where the said combination is heated and then into a second zone where the said combination is simultaneously compressed and heated,

e) - the said combination is then transferred into a third zone in which it is compressed and cooled,

f) - the said combination thus cooled is cut up at the exit of the third zone.

9. Process according to Claim 7, characterized in that:

a) - a first strip of fabric formed exclusively by commingled threads is deposited onto a moving conveyor,

b) - a sheet of chopped commingled threads is deposited onto this strip,

- c) - a second strip of fabric exclusively formed by commingled threads is deposited onto this sheet,
d) - a second sheet of chopped commingled threads is optionally deposited onto this latter strip of fabric,
5 e) - the strip(s)-sheet(s) combination thus formed is transferred into a first zone where the said combination is heated, and then into a second zone where the said combination is simultaneously compressed and heated,
10 f) - the said combination is transferred into a third zone in which it is compressed and cooled,
g) - the combination thus cooled is cut up at the exit of the third zone.
10. Process according to Claim 7, characterized in
15 that:
a) - a first strip of fabric formed exclusively by commingled threads is deposited onto a moving conveyor,
b) - one or more continuous commingled threads are deposited onto this strip,
20 c) - a second strip of fabric formed exclusively by commingled threads is deposited onto the said continuous thread(s),
d) - one or more continuous commingled threads or a sheet of chopped commingled threads is optionally
25 deposited onto this latter strip of fabric,
e) - this strip(s)-sheet(s) combination thus formed is transferred into a first zone where the said combination is heated, and then into a second zone where the said combination is simultaneously compressed
30 and heated,
f) - the said combination is transferred into a third zone in which it is compressed and cooled,
g) - the combination thus cooled is cut up at the exit of the third zone.
35 11. Process according to Claim 7 ~~any one of Claims 7 to 10~~, characterized in that the width of the sheet(s) of commingled threads is equal to the width of the

A

strip(s) of fabric and/or of knit with which it is (they are) combined.

12. Process according to ~~any one of the preceding claims~~, characterized in that the weight of glass which is deposited represents at least half of the total weight of material deposited onto the conveyor.

13. Device for implementing the process according to ~~either of Claims 8 and 9~~, characterized in that it includes: a storage device for windings of commingled threads, a cutter fed with the continuous threads extracted from the said windings, one or more devices ensuring the transfer, the storage and the distribution of the chopped commingled threads in the form of sheet(s), at least one device with a small barrel supporting at least two rolls of fabric of commingled threads, a conveyor onto which the said chopped threads and the strip(s) of fabric are deposited, a preheating oven placed at the end of the conveyor, a twin-belt press comprising heating drums in its upstream portion, cooled rolls in its downstream portion and, in its central portion, a heating zone followed by a cooling zone, and, lastly, an automatic guillotine device.

14. Device for implementing the process according to Claim 10, characterized in that it includes: a storage device for windings of commingled threads, a conveyor onto which the commingled threads are deposited in the form of strips of fabric and of continuous threads and, optionally, of chopped threads, upstream of the said conveyor a first device with a small barrel supporting at least two rolls of fabric, above the conveyor one or more devices for distribution of continuous commingled threads, downstream a second device with a small barrel supporting at least two rolls of fabric followed optionally by a second device for distribution of continuous thread or by a cutter and by a device for distribution of chopped threads, a preheating oven placed at the end of the conveyor, a twin-belt press comprising heating drums in its

upstream portion, cooled rolls in its downstream portion and, in its central portion, a heating zone followed by a cooling zone, and, lastly, an automatic guillotine device.

Add A' >

PATENT

PROCESS AND DEVICE FOR THE MANUFACTURE
OF A COMPOSITE MATERIAL

Applicant: VETROTEX FRANCE S.A.

Inventors: Jean-Paul DEBALME
Dominique LOUBINOUX

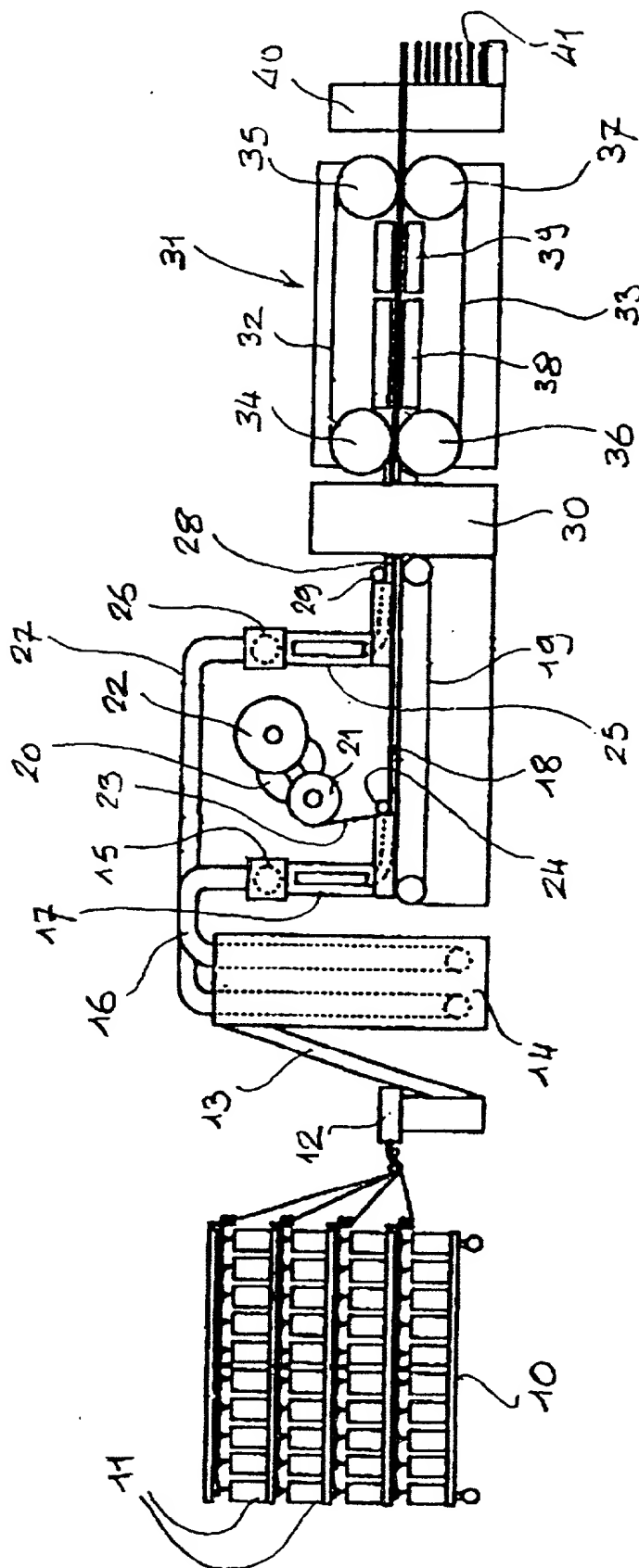
ABSTRACT

The invention relates to the manufacture of a composite product which consists:

- in continuously depositing onto a moving substrate glass threads of which at least 80 % by weight thereof are commingled threads consisting of glass filaments and of filaments of thermoplastic organic material which are intimately blended, the quantity of glass deposited representing more than 40 % by weight of the total quantity of material deposited in the form of glass threads and of organic material,
- in transferring this glass threads-organic material combination into a number of zones where the said combination is heated, compressed and cooled, the heating and/or the cooling of the said combination being simultaneously accompanied by its compression,
- in cutting up the said combination in the form of sheets or in winding it onto a rotating drum.

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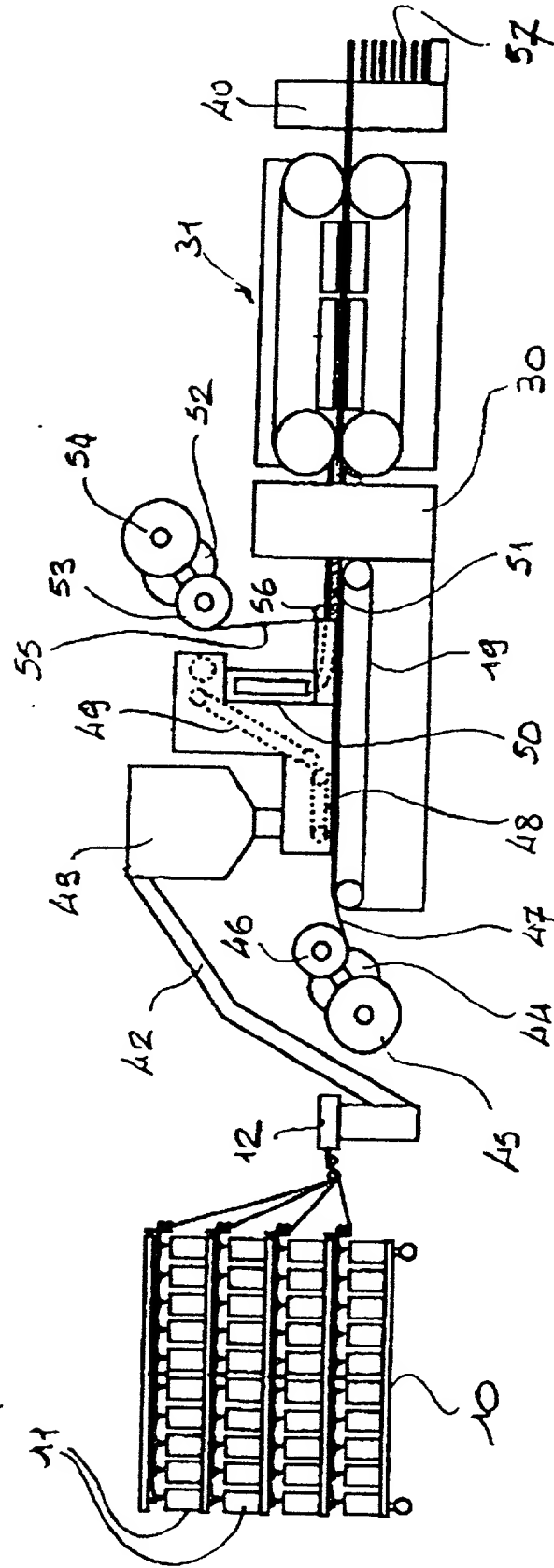
Fig. 1



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FIG. 2



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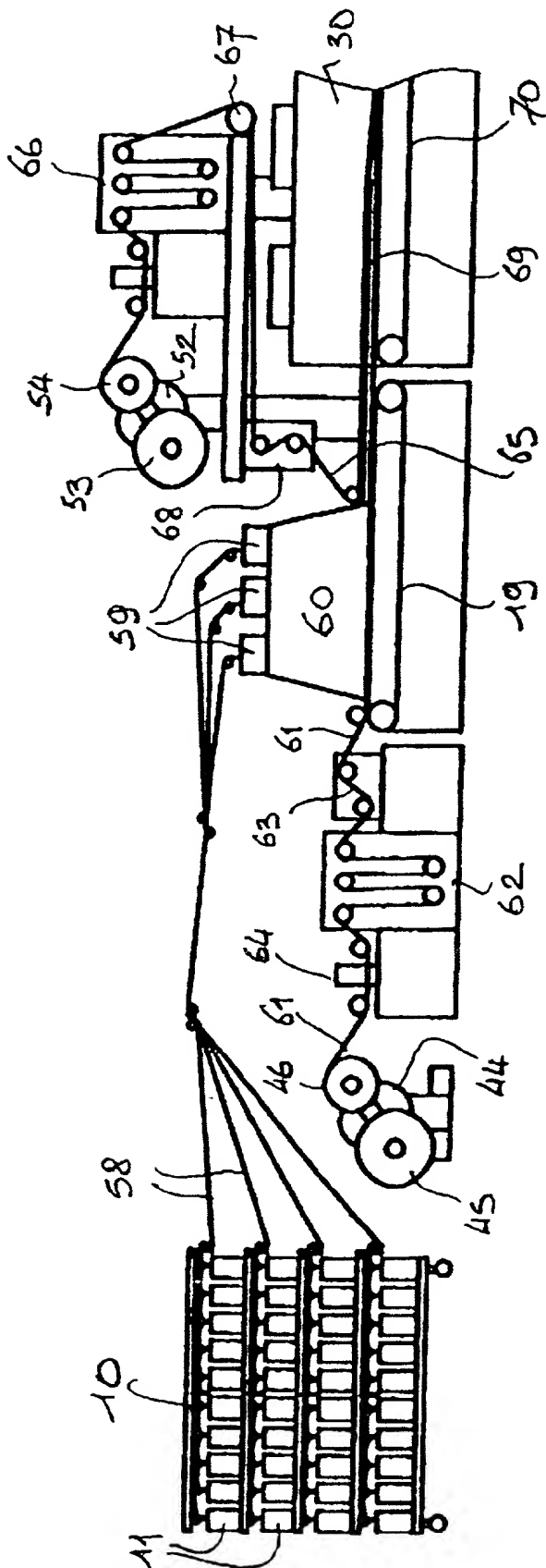


Fig. 3

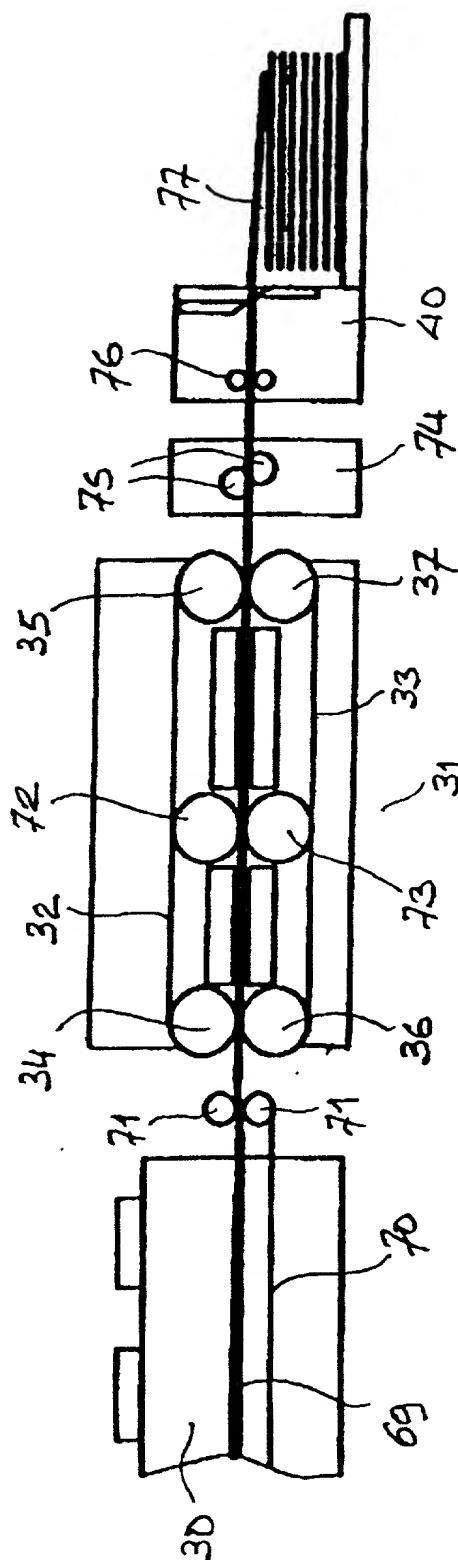
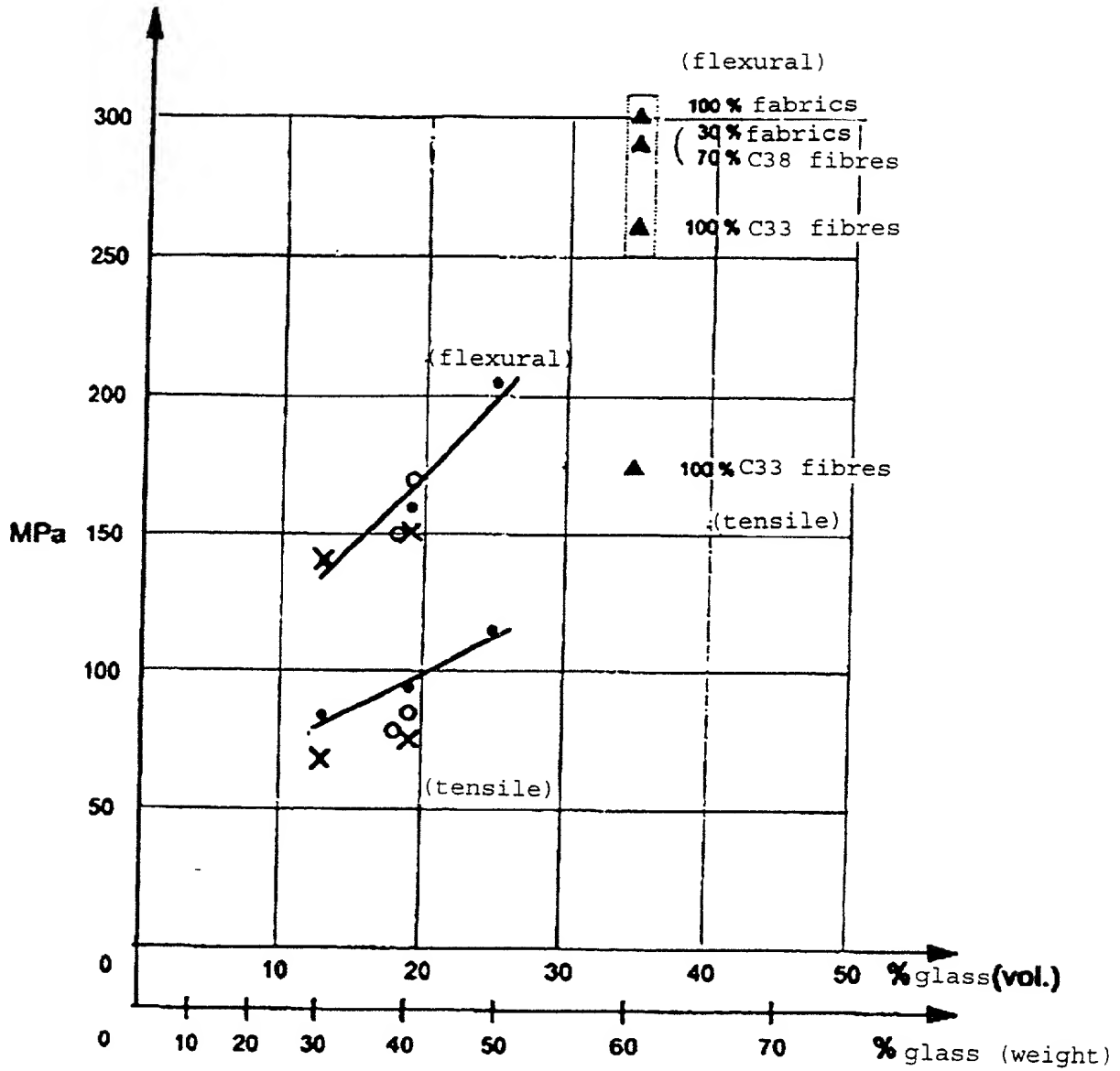


Fig. 4



Declaration, Power Of Attorney and Petition

Page 1 of 3

WE (I) the undersigned inventor(s), hereby declare(s) that:

My residence, post office address and citizenship are as stated below next to my name,

We (I) believe that we are (I am) the original, first, and joint (sole) inventor(s) of the subject matter which is claimed and for which a patent is sought on the invention entitled

PROCESS AND DEVICE FOR THE MANUFACTURE OF A COMPOSITE MATERIAL

the specification of which

☐ is attached hereto.

☐ was filed on _____ as

Application Serial No. _____

and amended on _____.

☒ was filed as PCT international application

Number PCT/FR97/00101

on January 17, 1997,

and was amended under PCT Article 19

on _____ (if applicable).

We (I) hereby state that we (I) have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

We (I) acknowledge the duty to disclose information known to be material to the patentability of this application as defined in Section 1.56 of Title 37 Code of Federal Regulations.

We (I) hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed. Prior Foreign Application(s)

Application No.	Country	Day/Month/Year	Priority Claimed
96/00578	France	19 January 1996	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
_____	_____	_____	<input type="checkbox"/> Yes <input type="checkbox"/> No
_____	_____	_____	<input type="checkbox"/> Yes <input type="checkbox"/> No
_____	_____	_____	<input type="checkbox"/> Yes <input type="checkbox"/> No

We (I) hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below.

(Application Number)	(Filing Date)
(Application Number)	(Filing Date)


We (I) hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

Application Serial No.	Filing Date	Status (pending, patented, abandoned)
PCT/FR97/00101	January 17, 1997	

And we (I) hereby appoint: Norman F. Oblon, Registration Number 24,618; Marvin J. Spivak, Registration Number 24,913; C. Irvin McClelland, Registration Number 21,124; Gregory J. Maier, Registration Number 25,599; Arthur I. Neustadt, Registration Number 24,854; Richard D. Kelly, Registration Number 27,757; James D. Hamilton, Registration Number 28,421; Eckhard H. Kuesters, Registration Number 28,870; Robert T. Pous, Registration Number 29,099; Charles L. Gholz, Registration Number 26,395; Vincent J. Sunderdick, Registration Number 29,004; William E. Beaumont, Registration Number 30,996; Steven B. Kelber, Registration Number 30,073; Robert F. Gnuse, Registration Number 27,295; Jean-Paul Lavalleye, Registration Number 31,451; Stephen G. Baxter, Registration Number 32,884; Martin M. Zoltick, Registration Number 35,745; Robert W. Hahl, Registration Number 33,893; Richard L. Treanor, Registration Number 36,379; Steven P. Weihrauch, Registration Number 32,829; John T. Goolkasian, Registration Number 26,142; Marc R. Labgold, Registration Number 34,651; William J. Healey, Registration Number 36,160; Richard L. Chinn, Registration Number 34,305; Steven E. Lipman, Registration Number 30,011; Carl E. Schlier, Registration Number 34,426; James J. Kulbaski, Registration Number 34,648; Catherine B. Richardson, Registration Number 39,007; Richard A. Neifeld, Registration Number 35,299; and J. Derek Mason, Registration Number 35,270; our (my) attorneys, with full powers of substitution and revocation, to prosecute this application and to transact all business in the Patent Office connected therewith; and we (I) hereby request that all correspondence regarding this application be sent to the firm of OBLON, SPIVAK, McCLELLAND, MAIER & NEUSTADT, P.C., whose Post Office Address is: Fourth Floor, 1755 Jefferson Davis Highway, Arlington, Virginia 22202.

We (I) declare that all statements made herein of our (my) own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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Signature of Inventor

Date

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Signature of Inventor

Date

Residence:

Citizen of:

Post Office Address:

NAME OF FIFTH JOINT INVENTOR

Signature of Inventor

Date

Residence:

Citizen of:

Post Office Address: